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Cholesterol Screening for Women: Who Is "At-Risk"?

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Abstract

Background—High cholesterol often precedes cardiovascular disease (CVD) and guidelines recommend cholesterol screening among at-risk women. Definitions of CVD risk vary and prevalence of dyslipidemia (abnormal total cholesterol, high-density lipoprotein (HDL-C), or non-HDL-C) among at-risk women may vary by age and definition of CVD risk.

Methods—This study used 2007–2008 National Health and Nutrition Examination Survey data (*n*=1,781), a representative sample of the U.S. civilian, non-institutionalized population, to estimate the proportion of women without previous dyslipidemia diagnosis who are U.S. Preventive Services Task Force (USPSTF) at-risk and American Heart Association (AHA) at-risk. We also report dyslipidemia prevalence stratified by age.

Results—Over half (55.0%) of younger women (20–44 years) and 74.2% of older women (≥45 years) were USPSTF at-risk, while nearly all younger and older women had at least one AHA risk factor (99.5% and 99.6%, respectively). Dyslipidemia prevalence among younger women was 47.3% (95% confidence interval [CI]: 42.2– 52.5) for USPSTF-at-risk and 39.5% (95% CI: 35.7–43.4) for AHA at-risk. Among older women, it was 65.5% (95% CI: 60.8–69.9) for USPSTF at-risk and 63.3% (95% CI: 59.0–67.4) for AHA at-risk.

Conclusions—The AHA risk definition identified 45% more young women and 25% more older women than the USPSTF risk definition; however, both definitions of at-risk identified similar prevalence estimates of dyslipidemia among women. Given a high prevalence of dyslipidemia among younger women, future research is needed to assess whether identification and treatment of young women with dyslipidemia will decrease CVD mortality among them later in life.

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Disclosure Statement

No competing financial interests exist.

Introduction

Cardiovascular disease (CVD) is the leading cause of death among women of all ages[1] and the third leading cause of death among women aged 18–44 years.[2] High cholesterol is a modifiable risk factor that often precedes heart disease. It also has reproductive health significance, as it has been associated with polycystic ovarian syndrome, the most common endocrine disorder inwomen of reproductive age and leading cause of infertility.[3,4] Cholesterol screening is the gateway to early detection and control of dyslipidemia. Dyslipidemia, a treatable condition characterized by abnormal total cholesterol, high- or low-density lipoproteins, is associated with atherogenesis. Cholesterol management is also a key strategy of the Healthy People 2020 and Department of Health and Human Services (DHHS) "Million Hearts" initiative.[5,6]

Most national guidelines recommend cholesterol screening for older (≥ 45 years) and reproductive age women (20–44 years) based on CVD risk. Definitions of increased CVD risk vary across guidelines[7–10] and the United States Preventive Services Task Force (USPSTF) makes no definitive recommendations for women 20 years or older without diabetes, previous personal history of coronary heart disease (CHD) or non-coronary atherosclerosis, premature family history of CVD, tobacco use, hypertension (HTN), and obesity (≥30 kg/ m^2).[10] Alternatively, the American Heart Association (AHA) Guidelines for CVD prevention in women recognizes a broader array of risk factors that, in addition to the USPSTF risk factors, include Framingham 10-year predicted CVD risk ≥ 10%, poor diet, physical inactivity, stroke, pre-hypertension, central adiposity, and conditions that are unique to or more prevalent among women.[7]

The rationale for risk-dependent cholesterol screening among women is that the few primary prevention lipid trials that enrolled women or those with lower CVD risk were not sufficiently powered to demonstrate significant reductions in the risk of coronary events.[11,12] Given different definitions of CVD risk, it is possible that a broader definition of CVD risk would identify more undiagnosed dyslipidemia. The purpose of this study was to estimate the prevalence of dyslipidemia among women of reproductive age and among women 45 years or older according to the USPSTF and AHA definitions of CVD risk.

Materials and Methods

Sample

Data were drawn from the National Health and Nutrition Examination Survey (NHANES), a representative sample of the U.S. civilian, non-institutionalized population.[13] Detailed descriptions of NHANES are available on the National Center for Health Statistics website.[13] Briefly, NHANES uses a complex, multistage, probability design and begins with in home personal interviewing. Next, physical examinations, lab tests, and additional questionnaires are administered in specially designed and equipped mobile examination centers. The overall response rate for completed examinations among all screened female participants was 75.5% (2007–2008).

Women age ≥ 20 years who reported no past diagnosis of high cholesterol were included (*n* = 2037). Women with missing data on non-fasting cholesterol measures and at-risk variables included in USPSTF and AHA criteria (*n* = 256, 12.6%)[7,8] were excluded, leaving a final analytic sample of *n* = 1,781. Data were de-identified and publically available; therefore, this research did not involve human subjects and was exempt from institutional review board review.

Definitions and measurement

Binary variables were created to connote CVD risk status that included risk factors for which data was available in NHANES, 2007–2008 (Table 1). USPSTF-at-risk was defined as presence of ≥ 1 of the following risk factors: CHD (ever being told by a doctor or other health professional that they have congestive heart failure, coronary heart disease, angina, or myocardial infarction), diabetes (ever told they had diabetes or current hemoglobin A1c measurement ≥6.5%), hypertension (self-reported current use of antihypertensive medication or average of ≤3 blood pressure [BP] measurements ≥140/90 mmHg), tobacco use (self-reported currently smoking every day or some days and ever smoking ≥100 cigarettes), obesity (body mass index: weight [kilograms]/ height [meters^2] ≥30),[10] and family history of CVD (heart attack or angina before age 50 in a close biological relative). AHA-at-risk was defined as ≥ 1 USPSTF risk factors or stroke (ever told they had a stroke), chronic kidney disease (self-reported physician diagnosis of weak or failing kidneys or diminished kidney function based on the glomerular filtration rate),[14] pre-hypertension (average of ≤3BP measurements 120–139/80–89 mmHg), central adiposity (waist circumference > 88 centimeters), poor diet (Table 2: self-reported mean intake of < 3 selected Dietary Approaches to Stop Hypertension [DASH][15] or AHA[7] recommended targets according to the average of two 24-hour recall interviews—if dietary information was missing for one day only the single completed dietary recall was used), physical inactivity (self-reported < 150 minutes of moderate- or < 75 minutes of vigorous-effort leisure time activity in a typical week, or an equivalent combination), gestational diabetes mellitus history (ever told they had diabetes during pregnancy but had not been diagnosed with diabetes other than during pregnancy), rheumatoid arthritis (ever told they had this condition), and Framingham 10-year CHD risk ≥ 10% (Table 1, details on the calculation of Framingham scores and 10-year risk estimates available at: www.nhlbi.nih.gov/guidelines/cholesterol[8]). The data did not include measures of gestational hypertension or other systemic autoimmune collagen-vascular disease like lupus, which are also identified as risk factors in AHA guidelines.

Four binary (yes/no) measures of dyslipidemia were created based on non-fasting, lab results: high total cholesterol (TC), low high-density lipoprotein cholesterol (HDL-C), high non-HDL-C (surrogate for low-density lipoprotein cholesterol [LDL-C]), and any dyslipidemia. The University of Minnesota performed the testing using Roche Modular P chemistry analyzer equipment (Roche Diagnostics) as described elsewhere.[16] High TC was defined as ≥ 200 mg/dL. Low HDL-C was defined as <40 mg/dL. Because LDL-C tests require fasting and LDL-C was only collected on a sub-sample, non-HDL-C was used. Established thresholds for high LDL-C in the National Cholesterol Education Program Adult Treatment Panel (NCEP ATP III) are risk-based (defined below) and include high risk (≥

100 mg/dL), intermediate (≥ 130 mg/dL), and low (≥ 160 mg/dL).[8] It is generally accepted that a reasonable goal for non-HDL cholesterol is 30 mg/dL higher than the LDL-cholesterol threshold.[8] Therefore, 30 mg/dL was added to each established risk group threshold to estimate high non-HDL-C. Briefly, high non-HDL-C was defined as ≥ 130 mg/dL among the high risk group, which included women with coronary heart disease (CHD) or CHD-equivalent conditions (congestive heart failure, angina, myocardial infarction, stroke, and diabetes) and those with ≥2 major CHD risk factors (cigarette smoking, hypertension or taking anti-hypertensive medication, age ≥ 55 years, family history of premature CHD, and HDL-C <40 mg/dL) and >20% Framingham 10-year CHD risk estimates. Non-HDL-C ≥ 160 mg/dL was coded as high among the intermediate risk group, which included women who had ≥2 major CHD risk factors and ≤20% Framingham 10-year CHD risk estimates. Non-HDL-C ≥ 190 mg/dL was coded as high among the low risk group of women who had 0–1 major CHD risk factors. Any dyslipidemia was defined as high TC, low HDL-C or high non-HDL-C.

Sociodemographic characteristics included age (20–44 years, ≥45 years), race/ethnicity (Mexican American, white non-Hispanic, black non-Hispanic, other/multiracial) education (< 12th grade, 12th grade/GED/ or high school graduate, some college or associates degree, ≥ college graduate) and annual family income (0–$24,999, $25,000–$44,999, $45,000–$74,999, ≥ $75,000, unknown). Health care access indicators were based on self-report and included health insurance (uninsured or private single service plan only, public, private), and time since last visit with a health care provider (≤ 12 months, >1 year and ≤3 years, >3 years, or never).

Data analysis

Data analyses were conducted in 2012 using Stata software (version 11; StataCorp) and examination weights, which adjust for unequal probability of selection, interview, and examination non-response and non-coverage. These data are representative of the US female population aged ≥20 years for 2007–2008 who were not previously diagnosed with high cholesterol. The prevalence of sociodemographic characteristics, health care access indicators, CVD risk factors, and at-risk women according to USPSTF and AHA definitions of CVD risk were estimated and stratified by age (20–44 years versus ≥ 45 years), since the risk of developing dyslipidemia increases with age. Differences in distributions of CVD risk factors by age were assessed using Pearson chi square tests ($p < 0.05$) with Rao and Scott second-order corrections.[17] The prevalence of dyslipidemia (high TC, low HDL-C, high non-HDL-C, and any dyslipidemia) was calculated by risk category (USPSTF-at-risk versus AHA-at-risk) and stratified by risk and age category. Dyslipidemia prevalence and case to screening ratio were estimated by dyslipidemia type among women at-risk according to AHA guidelines but not at-risk according to USPSTF guidelines.

Results

Table 3 displays the sociodemographic characteristics, health care access indicators, and CVD risk factors for a national sample of women not previously diagnosed with high cholesterol by age: reproductive (20–44 years), older (≥ 45 years), and all women age ≥20

years. Approximately half of the women in this sample were reproductive age (51.2%); most were non-Hispanic white (68.0%), and had at least some college education (57.4%). A larger percentage of reproductive age women reported incomes $45,000–$74,000 (25.0%) compared with older women (18.5%). The vast majority (96.8%) had seen a health care provider within the previous three years and 62.1% reported receipt of a cholesterol test within the previous five years. Among all women, 34.2% were obese, 90.8% had an unhealthy diet, and 68.1% were insufficiently active or inactive. Rheumatoid arthritis was reported by 4.0% of the sample and 5.2% reported having a history of gestational diabetes. The prevalence of CVD risk factors was generally higher among older women with the exceptions of current smoking and unhealthy diet, which were higher among reproductive age women ($p < 0.05$). Over half of reproductive age women (55.0%) and 74.2% of older women were USPSTF-at-risk. Nearly all reproductive age and older women were AHA-at-risk (99.5% and 99.6%, respectively).

Among USPSTF-at-risk, reproductive age women, nearly half (47.3%) had some form of dyslipidemia, one-third (33.0%) had high TC, 20.7% had low HDL-C, and 13.1% had high non-HDL-C (Table 4). Among older, USPSTF-at-risk women, 65.5% had dyslipidemia, 54.5% had high TC, 12.5% had low HDL-C, and 36.2% had high non-HDL-C (Table 4). Prevalence estimates of non-HDL-C for reproductive age and older women alike were consistently lower using AHA criteria (8.0% and 28.3%, respectively) than with the USPSTF criteria (13.1% and 36.2%, respectively), and the same pattern held for other types of dyslipidemia, although confidence intervals overlapped. Of women identified as AHA-at-risk but not USPSTF-at-risk, 38.3% had dyslipidemia. Among AHA-at-risk only women (i.e., currently not eligible for USPSTF-risk based cholesterol screening), 1 in 35 have high non-HDL-C warranting lifestyle modification or pharmacologic management. The majority of women who were AHA-at-risk only were reproductive age (69.0%), physically inactive (57.6%), or had an unhealthy diet (92.1%; not shown).

Discussion

Nearly all reproductive age and older women had at least one CVD risk factor according to AHA guidelines (99.5% and 99.6%, respectively).[7] This is not surprising as others have reported only 1% of the U.S. population has ideal cardiovascular health.[18,19] Unhealthy diet was prevalent among younger (93%) and older (88%) women alike. A high prevalence (38%) of dyslipidemia was reported among AHA-at-risk women. These women (estimated >25 million) had no previous personal history of high cholesterol, diabetes, CHD or non-coronary atherosclerosis, premature family history of CVD, or current tobacco use, hypertension (HTN), or obesity (≥30kg/m^2). This represents nearly 10 million additional new cases of any dyslipidemia and over 715,000 cases of high non-HDL-C (a proxy for LDL-C—the primary target of pharmacologic treatment).

High prevalence of dyslipidemia was reported among reproductive age women (40%, AHA-at-risk and 47%, USPSTF-at-risk) and over half had not had cholesterol screening within the previous 5 years. Pharmacologic and lifestyle interventions for dyslipidemia are available for reproductive age women, and this age group frequently interacts with the health care system for their reproductive health care needs. Therefore, reproductive health visits may be

perfect opportunities to educate, screen, and treat or refer younger women with dyslipidemia. Younger women may perceive their risk of dyslipidemia to be low, and, therefore not realize the importance of heart-healthy lifestyles. As well, medical providers may consider cholesterol screening a low priority during reproductive care visits.

NCEP ATP III, which is supported by AHA, recommends universal screening for women ≥20 years.[7,8] However, the USPSTF's most recent review of the literature found insufficient evidence of net benefit for lipid screening in all young adults and women 45 years or older not at increased risk for coronary heart disease. Given that unhealthy diet, abdominal obesity, and physical inactivity were the most prevalent AHA risk factors among younger and older women alike, and therapeutic lifestyle changes are indicated more often than is drug therapy for management of dyslipidemia in young women, our results indicate that a large proportion of women of reproductive age would benefit from lifestyle counseling.

While this study provides prevalence estimates of dyslipidemia based on USPSTF and AHA definitions of risk, what it does not address is the number of CVD events that would be averted if these cases of dyslipidemia were diagnosed and treated. The practical costs of screening and the risk-to-benefit ratio of statin therapy for these additional women need to be estimated and considered. Future research is needed to assess whether identification and treatment of all women with dyslipidemia will decrease CVD mortality among them later in life.

The findings in this report are subject to limitations. First, measurement error is possible. Self-reported data are subject to recall bias, particularly time since last screening, 24-hour diet recall, and physical activity. Specifically, respondents tend to underestimate time since last screening and may self-report screening occurred more recently than it actually did.[20,21] Survey respondents also tend to overestimate physical activity and under report food intake.[22–24] In one study, less than 10% of adults met the recommended level of physical activity when objectively measured using accelerometers, but 62% achieved recommended physical activity levels when assessed by self-report.[22] Conversely, the mean percentage of energy intake underreporting in studies that use the 24 hour recall assessment method ranges from 22%–67% (median 31%).[23] Furthermore, the approach used to estimate usual dietary intake may lead to misclassification. Unhealthy diet was conservatively estimated by using most of the available measures included in the AHA recommendations for a healthy diet, but key recommended nutrients (fruits, vegetables, and nuts) were unavailable. Nonetheless, nearly all women met the criteria for having an unhealthy diet. Second, bias from misclassification is possible. While the NCEP ATP III suggests that non-HDL-C may be preferred over LDL-C for clinical purposes of evaluating risk, non-HDL-C may be a less reliable predictor of risk than LDL-C in individuals with high triglyceride levels.[8] As a sensitivity analysis, we estimated prevalence of high LDL-C on the fasting subsample and results were not statistically different from our reported prevalence of high non-HDL-C. Because the NHANES asks about family history of heart attack before age 50—which is broader than the USPSTF definition (<50 for male relatives and <60 for female relatives) or the AHA definition (<55 in men and <65 in women)—misclassification may overestimate prevalence estimates of the two at-risk groups. Additionally, CVD prevalence may be overestimated as some women with congenital heart disease or other heart conditions

unrelated to atherosclerosis may be misclassified. This may have inflated overall reported CVD prevalence, estimates that use CVD as basis for determining risk, including variables for Framingham 10-year CHD risk, USPSTF and AHA risk categories, and prevalence of high non-HDL-C. However, we believe this would be rare. Conversely, the percent of AHA-at-risk women may be underestimated since NHANES does not collect information on other important CVD risk factors such as gestational hypertension or lupus.

Conclusion

Given half of reproductive age women and nearly three-fourths of older women in this sample were USPSTF-at-risk but nearly all women were AHA-at-risk, education is needed to inform the public and professionals about CVD risk in women.[25] In order for medical providers to appropriately identify, diagnose, monitor, and treat at-risk women, consensus is needed about what at-risk means. The USPSTF definition of at-risk identified a similar percentage of women with dyslipidemia as the AHA definition, but the difference in absolute numbers is noteworthy. Given a high prevalence of AHA risk factors and dyslipidemia among young women, future research is needed to assess whether identification and treatment of young women with dyslipidemia will decrease CVD mortality among them later in life.

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Table 1

Source of Data on Cardiovascular Disease Risk Factor According to U.S. Preventive Services Task Force and American Heart Association, National Health and Nutrition Examination Survey, 2007–2008

Risk factors	USPSTF[10]	AHA[7]	NHANES measure
CVD or equivalent[a,b]			Self-reported:
	X	X	Congestive heart failure
	X	X	Coronary heart disease
	X	X	Angina, also called angina pectoris
	X	X	Heart attack (also called myocardial infarction)
		X	Stroke
		X	Weak or failing kidneys
		X	End-stage or chronic kidney disease defined by albumin to creatinine ratio and glomerular filtration rate
		X	Diabetes
Diabetes	X	X	Self-reported medical diagnosis of diabetes or sugar diabetes
	X	X	A1c test ≥6.5%
Hypertension	X	X	Prescribed medicine for hypertension
	X	X	Mean SBP ≥140mm Hg (≥2 measurements)
	X	X	Mean DBP ≥90mm Hg (≥2 measurements)
Pre-hypertension		X	Mean SBP 120–139mm Hg (≥2 measurements)
		X	Mean DBP 80–89mm Hg (≥2 measurements)
Tobacco Use	X	X	Self-reported current cigarette smoking and ≥100 cigarettes smoked in lifetime
Obesity	X	X	Calculated BMI from body measurements
		X	Central adiposity (waist circumference)
Family history of premature CVD[c,d]	X	X	Blood relative ever medically diagnosed with a heart attack or angina before the age of 50
Poor diet		X	Non-accordance with DASH-like diet
Physical inactivity		X	Self-reported time spent doing moderate- or vigorous-intensity activity as part of work, sports, fitness, or recreational activities
Rheumatoid arthritis		X	Self-reported medical diagnosis of rheumatoid arthritis
Gestational diabetes		X	Self-reported medical diagnosis of gestational diabetes
10-year predicted CVD Framingham risk ≥10%		X	Framingham Point Scores based on age, total cholesterol, HDL-C, smoking status, and blood pressure treatment and control

[a] U.S. Preventive Services Task Force (USPSTF) defines as personal previous history of coronary heart disease (CHD) or non-coronary atherosclerosis (e.g., peripheral arterial disease, abdominal aortic aneurism, or carotid artery stenosis).

[b] American Heart Association (AHA) defines as clinically manifest CHD, cerebrovascular disease or peripheral arterial disease, abdominal aortic aneurism, or end-stage or chronic kidney disease.

[c] USPSTF defines as cardiovascular disease (CVD) diagnosis in a close biological relative before age 50 for male relatives (father/brother) or age 60 in female relatives (mother/sister).

[d] AHA defines as premature CVD occurring in first-degree relatives in men <55 years or in women <65 years.

BMI, body mass index; DASH, Dietary Approaches to Stop Hypertension; DBP, diastolic blood pressure; HDL-C, high-density lipoprotein cholesterol; SBP, systolic blood pressure; NHANES, National Health and Nutrition Examination Survey.

Table 2

Recommended Dash[15] and AHA[7] Targets for Healthy Diet

Component	Target
DASH	
Fiber	≥ 31g/2,100 kcal per day[a]
Saturated fat	≤6% energy per day
Protein	≥ 18% of energy per day
Sodium	≤ 2.4 g/2,100 kcal per day[b]
AHA	
Fish	≥ 2 3.5-ounce servings per week
Alcohol	≤ 1 serving per day[c]

[a] Accordance with target defined as ≥14.8 g/1,000 kcal.

[b] Accordance with target defined as ≤1,143mg/1,000kcal based on the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure recom-mendation.[26]

[c] Equivalent of one serving (www.cdc.gov/alcohol/faqs.htm).

Table 3

Sample Characteristics for Women Aged 20 or More Years, Based on National Health and Nutrition Examination Survey, 2007–2008*

Variables	20–44 years percent (SD) (*n*=911, 51.2%)	≥ 45 years percent (SD) (*n*=870, 48.8%)	Overall percent (SD) (*n*=1,781)
Sociodemographic characteristics			
Race/ethnicity			
Mexican American	11.5 (0.8)	6.0 (0.6)	9.1 (0.5)
White, non-Hispanic	63.0 (1.7)	74.5 (1.6)	68.0 (1.2)
Black, non-Hispanic	13.0 (1.0)	10.7 (0.9)	12.0 (0.7)
Other race/multi-racial	12.6 (1.2)	8.8 (1.1)	10.9 (0.8)
Annual family income			
$0-$24,999	23.4 (1.5)	26.7 (1.7)	24.8 (1.1)
$25,000-$44,999	19.7 (1.5)	19.7 (1.7)	19.7 (1.1)
$45,000-$74,999	25.0 (1.8)	18.5 (1.9)	22.1 (1.3)
≥ $75,000	27.9 (1.9)	28.1 (2.2)	28.0 (1.5)
Unknown	4.1 (0.7)	7.0 (1.1)	5.4 (0.6)
Education (highest level)			
Less than 12th grade	17.8 (1.3)	22.5 (1.6)	19.9 (1.0)
12th grade, GED, or high school graduate	20.2 (1.5)	26.1 (2.0)	22.8 (1.2)
Some college or associates degree	36.3 (2.0)	26.7 (2.0)	32.1 (1.4)
College graduate or above	25.7 (1.9)	24.8 (2.1)	25.3 (1.4)
Health care access indicators			
Health insurance[a]			
Underinsured or uninsured[b]	24.8 (1.6)	12.7 (1.3)	19.5 (1.1)
Public[c]	14.7 (1.3)	19.3 (1.5)	16.7 (1.0)
Private	60.5 (1.9)	68.0 (1.9)	63.8 (1.3)
Time since last visit with a health care provide[†]			
12 months or less	87.7 (1.3)	91.4 (1.3)	89.3 (0.9)
>1 year and <3 years	8.7 (1.1)	6.0 (1.2)	7.5 (0.8)
More than 3 years or never	3.7 (0.7)	2.6 (0.5)	3.2 (0.5)
Cholesterol checked within past 5 years			
No	51.4 (2.1)	21.1 (1.8)	37.9 (1.5)
Yes	48.6 (2.1)	78.9 (1.8)	62.1 (1.5)
Cardiovascular disease (CVD) risk factors			
CVD[d]			
No	99.2 (0.3)	93.9 (0.8)	96.9 (0.4)
Yes	0.8 (0.8)	6.1 (0.8)	3.1 (0.4)
Diabetes			
No	90.2 (1.1)	57.2 (2.1)	75.6 (1.2)
Pre-diabetes	7.6 (1.0)	29.1 (1.9)	17.1 (1.0)
Yes	2.3 (0.5)	13.7 (1.3)	7.3 (0.6)

Variables	20–44 years percent (SD) (*n*=911, 51.2%)	≥ 45 years percent (SD) (*n*=870, 48.8%)	Overall percent (SD) (*n*=1,781)
Blood pressure status			
Normal	75.8 (1.7)	31.7(2.2)	56.3 (1.5)
Pre-hypertension[e]	16.7 (1.5)	25.4 (2.0)	20.6 (1.2)
Hypertension[f]	7.5 (1.0)	43.0 (2.2)	23.3 (1.2)
High blood cholesterol[g]			
No	60.5 (2.0)	36.6 (2.2)	50.0 (1.5)
Yes	39.5 (2.0)	63.5 (2.2)	50.0 (1.5)
Current tobacco use[†]			
No	77.0 (1.7)	81.6 (1.7)	79.0 (1.2)
Yes	23.0 (1.7)	18.4 (1.7)	21.0 (1.2)
Obesity[h,†]			
No	66.2 (1.9)	65.4 (2.1)	65.9 (1.4)
Yes	33.8 (1.9)	34.6 (2.1)	34.2 (1.4)
Abdominal obesity[i]			
No	46.2 (2.0)	34.5 (2.3)	58.9 (1.5)
Yes	53.8 (2.0)	65.5 (2.3)	41.1 (1.5)
Family history of CVD[j]			
No	88.3 (1.3)	83.3 (1.6)	86.1 (1.0)
Yes	11.7 (1.3)	16.7 (1.6)	13.9 (1.0)
Unhealthy diet			
No	6.8 (1.0)	12.4 (1.5)	9.2 (0.9)
Yes	93.2 (1.0)	87.6 (1.5)	90.8 (0.9)
Physical activity[k]			
Inactive	42.5 (1.9)	58.2 (2.3)	49.4 (1.5)
Insufficiently active	20.5 (1.7)	16.4 (1.7)	18.7 (1.2)
Physically active	37.0 (2.0)	25.4 (2.1)	31.9 (1.5)
Rheumatoid arthritis			
No	98.2 (0.5)	93.3 (0.9)	96.0 (0.5)
Yes	1.8 (0.5)	6.7 (0.9)	4.0 (0.5)
Gestational diabetes[†]			
No	93.8 (1.0)	96.2 (0.9)	94.9 (0.7)
Yes	6.2 (1.0)	3.8 (0.9)	5.2 (0.7)
10-year CHD risk[l]			
<10%	99.1 (0.3)	80.5 (1.5)	90.9 (0.7)
10–20%	0.2 (0.1)	10.4 (1.2)	4.6 (0.5)
>20%	0.8 (0.3)	9.1 (1.0)	4.5 (0.5)
At risk according to USPSTF guidelines[m]			
No	45.0 (2.0)	25.8 (2.1)	36.6 (1.5)
Yes	55.0 (2.0)	74.2 (2.1)	63.4 (1.5)

Variables	20–44 years percent (SD) (*n*=911, 51.2%)	≥ 45 years percent (SD) (*n*=870, 48.8%)	Overall percent (SD) (*n*=1,781)
At risk according to AHA guidelines[n,†]			
No	0.5 (0.2)	0.4 (0.4)	0.5 (0.2)
Yes	99.5 (0.2)	99.6 (0.4)	99.5 (0.2)

[*] Weighted percentages (standard errors) presented; weighted *n* = 69,597,631. Percent totals may not sum to 100% due to rounding; chi-square <0.05 except as noted.

[†] Differences between groups are not statistically significant; $p<0.05$.

[a] Persons with more than one type of insurance were assigned to the first appropriate category in the hierarchy of coverage comprehensiveness.

[b] Includes persons with no coverage, and private single service plans.

[c] Includes Medicaid, MediGap, Medicare, SCHIP, IHS coverage, military insurance, and state-sponsored or other governmental insurance plans.

[d] Includes coronary heart disease, angina pectoris, myocardial infarction, stroke, and other heart disease.

[e] Defined as mean systolic blood pressure 120–139 mm Hg or diastolic blood pressure 80–89 mm Hg based on two or more measures.

[f] Defined as mean systolic blood pressure ≥ 140 mm Hg or diastolic blood pressure ≥ 90 mm Hg based on two or more measures.

[g] Defined as high TC (≥ 200 mg/dL), low HDL-C (<40mg/dL), or high non-HDL according to thresholds for risk levels in ATP III plus 30 mg/dL; high non-HDL-C defined as ≥ 130 mg/dL if CHD or CHD equivalent, ≥ 160 mg/dL if two or more risk factors and Framingham 10-year risk < 20%, and ≥ 190 mg/dL if 0–1 risk factors.

[h] Defined as ≥30 weight (kg) / [height (m)]^2.

[i] Defined as waist circumference > 88 centimeters.

[j] Having a living or deceased close biological relative who was told they had a heart attack or angina before age 50 years.

[k] Inactive: 0 minutes/week; insufficiently active: <149 minutes/week; active: 150+ minutes/week.

[l] Framingham point scores and 10-year risk estimates are available at: www.nhlbi.nih.gov/guidelines/cholesterol; CVD or CVD equivalent considered >20%.

[m] As defined by the United States Preventive Services Task Force;[10] includes diabetes, personal or premature family history of CVD, tobacco use, hypertension, and obesity.

[n] Defined by the American Heart Association;[7] includes personal or premature family history of CVD, stroke, diabetes, 10-year predicted CVD risk ≥ 10%, cigarette smoking, pre-hypertension, hypertension, hypertension treatment, dyslipidemia, dyslipidemia treatment, obesity/ central adiposity, poor diet, physical inactivity, rheumatoid arthritis, and history of gestational diabetes.

IHS, Indian Health Service; SCHIP, State Children's Health Insurance Program.

Table 4

Prevalence of Dyslipidemia* Among Women Aged ≥20 Years by Risk Category and Age Group, Based on National Health and Nutrition Examination Survey, 2007–2008 (*N*=1,781)†

Risk category	At-risk population percent (95% CI)	High total cholesterol (TC) percent (95% CI)	Low HDL-C percent (95% CI)	High non-HDL-C percent (95% CI)	Any dyslipidemia percent (95% CI)
Women age 20–44 years (*n* = 911)					
At risk, according to USPSTF guidelines‡	55.0 (51.0–58.9)	33.0 (28.4–37.9)	20.7 (16.9–25.1)	13.1 (10.2–16.8)	47.3 (42.2–52.5)
At risk, according to AHA guidelines§	99.5 (98.8–99.8)	29.4 (26.0–33.1)	14.2 (11.7–17.1)	8.0 (6.3–10.3)	39.5 (35.7–43.4)
Women age ≥45 years (*n* = 870)					
At risk, according to USPSTF guidelines	74.2 (69.9–78.0)	54.5 (49.6–59.2)	12.5 (9.6–16.1)	36.2 (31.7–40.9)	65.5 (60.8–69.9)
At risk, according to AHA guidelines	99.6 (97.4–99.9)	54.6 (50.3–58.9)	9.8 (7.5–12.6)	28.3 (24.7–32.2)	63.3 (59.0–67.4)
All women (*n* = 1,781)					
At risk, according to AHA guidelines but not according to USPSTF guidelines	36.1 (33.7–39.5)	34.3 (29.6–39.3)	4.8 (3.0–7.6)	2.9 (1.6–4.9)	38.3 (33.4–43.4)

*Dyslipidemia defined as high TC (≥ 200 mg/dL), low HDL-C (< 40 mg/dL), or high non-HDL according to thresholds for risk levels in the National Cholesterol Education Program's Adult Treatment Panel III plus 30 mg/dL; high non-HDL-C defined as < 130 mg/dL if CHD or CHD equivalent, or >20% Framingham 10-year CHD risk estimate and 2+ risk factors, < 160 mg/dL if 2+ risk factors and Framingham 10-year risk < 20%, and < 190 mg/dL if 0–1 risk factors.

†Based on National Health and Nutrition Examination Survey, 2007–2008; weighted *n* = 69,597,631 (overall), *n* = 38,933,625 (age 20–44 years), *n* = 30,664,006 (age ≥45 years).

‡As defined by the United States Preventive Services Task Force;[10] Risk factors include diabetes, personal or premature family history of CVD, tobacco use, hypertension, and obesity.

§As defined by the American Heart Association;[7] Risk factors include personal or premature family history of CVD, stroke, diabetes, 10-year predicted CVD risk ≥ 10%, cigarette smoking, pre-hypertension, hypertension, hypertension treatment, dyslipidemia, dyslipidemia treatment, obesity/central adiposity, poor diet, physical inactivity, rheumatoid arthritis, and history of gestational diabetes.

CI, confidence interval.